The Anterior Cruciate Ligament (ACL) is one of the primary stabilizers of the knee joint. The primary role of the ACL is to prevent the tibia (shin bone) from moving forward on the femur (thigh bone), while also providing some rotational stability. Soccer, basketball, and football have higher rates of ACL injuries due to the types of movements involved in the sport: planting, cutting, deceleration, and landing. The treatment of an ACL injury depends on the severity, what other structures are involved in the injury (meniscus, MCL, etc.), and the level of activity of the individual. In many cases an ACL injury requires surgical repair.

Injury Statistics

Overall, it is estimated that between 1 in 1,000 to 1 in 5,000 people will sustain an ACL injury in their lifetime, resulting in approximately 200,000 reconstructions per year. 72% of injuries to the ACL occur from non-contact activities and 70% are related to athletics participation.

The recovery process, when reconstruction is necessary, involves a long recovery process post-surgery and is estimated to cost $5,000 to $17,000. Following reconstruction 82% of individuals are able to return to athletics participation. However, it should be noted that 63% return to pre-injury participation levels and roughly 50% return to pre-injury competitive sport levels.

Risk Factors

There are many risk factors that come in to play with ACL injuries. Some of these risk factors can be modified through injury prevention programs, while others are non-modifiable. Some modifiable risk factors related to ACL injuries include strength and conditioning levels, neuromuscular control, technique, and mechanics. Modifiable risk factors will be discussed in more detail in the “Prevention” section of this document. Non-modifiable risk factors including gender, anatomy, age, injury history, and sport participation, will be discussed below.
ACL INJURIES: THE BASICS

Gender

Although males account for the greatest total number of ACL injuries, females in high school and collegiate athletics are at a greater risk of injury. Female athletes are at a 2 to 6 times greater risk of suffering an ACL tear than males in the same age group. Factors that have been linked to increased ACL injury risk include anatomical difference, biomechanical differences, and hormonal differences. Anatomical differences will be discussed in the next section, titled “Anatomy”.

Biomechanical differences, although under the gender subcategory of non-modifiable risk factors, can be reduced through injury prevention techniques. The biomechanics of various activities have been observed with focus on knee valgus. It is believed that knee valgus may be a key risk factor in female ACL injury risk. Improving landing technique has been shown to drastically reduce the incidence of ACL injury in this population.

Hormonal differences are being continually researched, as there is no clear consensus on the role of hormones in ACL injury. With that being said, it is believed that there are certain points during the menstrual cycle where female athletes are more susceptible to ligamentous injury, but the exact timing is still heavily debated.

Anatomy

Research on anatomical differences has been widely debated over the past several years, but are introduced as possible risk factors. One anatomical difference that may account for ACL injury incidence in female athletes is decreased ACL volume. It is believed that a narrower and/or shallower intercondylar notch leads to decreased ACL volume. These attributes of notch size are typically witnessed in female athlete.

Another anatomical difference between male and female athletes is that female athletes tend to have wider hips than their male counterparts, which may put them at an increased risk of injury. Wider hips lead to an increased Q-angle, which is the angle between the ASIS of the hip bone and the middle of the patella. An increased Q-angle increases the amount of stress placed through the knee by increasing valgus loads. This increased load on the knee leads to increased load through the ACL and other support structures around the knee.
Prevention

Although various risk factors exist that cannot be modified, there is strong evidence supporting the use of prevention programs to lower risk associated with modifiable risk factors. The literature supports the use of neuromuscular training programs that combine strength training, plyometrics, agility, flexibility, and balance and proprioception activities. Several injury prevention programs currently exist and are outlined below.

Prevention programs have been shown to reduce the risk of lower extremity injury by 30 to 68%, knee injury by 26.9%, and ACL injury by 50-62%. Effective programs are performed a minimum of 2 to 3 times per week and are at least 15 to 20 minutes in duration. Effective prevention programs are also monitored by someone (coach, athletic trainer, physical therapist, etc.) that is able to give corrective feedback on the activities being performed (form, technique, etc.). Prevention programs are effective because they improve strength, decrease biomechanical risk factors, and reduces knee valgus and impact forces. An additional benefit of performing an injury prevention program is the potential performance benefits that go along with performing these activities.

The best time to introduce prevention programs to athletes is during early adolescence when they are able to quickly develop neuromuscular control. In addition to injury prevention benefits, these programs have also been shown to increase athletic performance through different skills. Examples of some highly-researched prevention programs include the FIFA 11+ program (11+, 11+ kids), the PEP program (Prevent Injury and Enhance Performance), and the KIPP program (Knee Injury Prevention Program) to name a few.